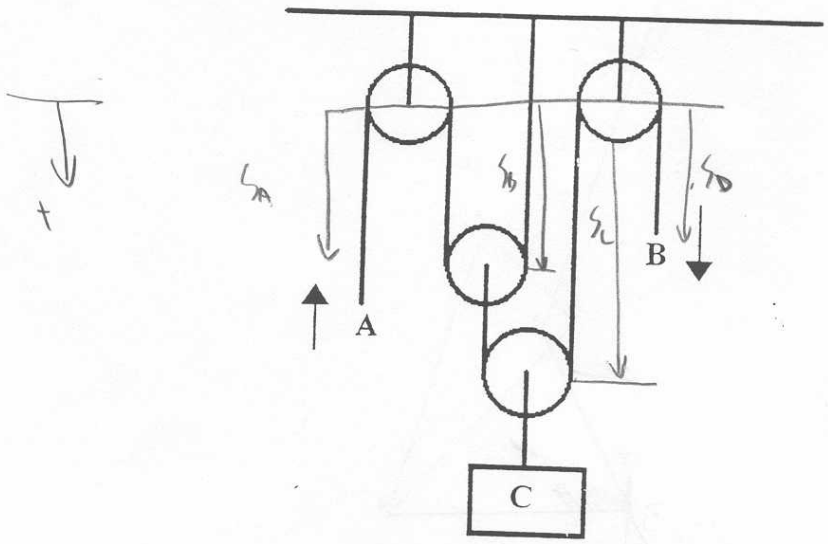
Q1) For the following pulley arrangement the velocity of point A is constant at 12 m/s upwards, while the position of point B is described by the equation: $S_B = 0.5t^3$ in the downward direction. Determine (a) the time at which block C momentarily stops after t = 0s, (b) the relative velocity and acceleration of block C with respect to point B at t = 5s, and (c) the velocity of block C for t = 0, 1, 2, 3, 4, 5 s. Construct the v-t graph for block C for the first 5 seconds.



$V_B = 1.5t^2$

$S_A + 2S_B = l_1$

$S_C - S_B + S_D = l_2$

$V_A + 2V_B = 0$ $\quad V_C - V_B + V_D = 0$

$V_C + V_D = V_B$

$V_A = 2 - 1.5t^2$

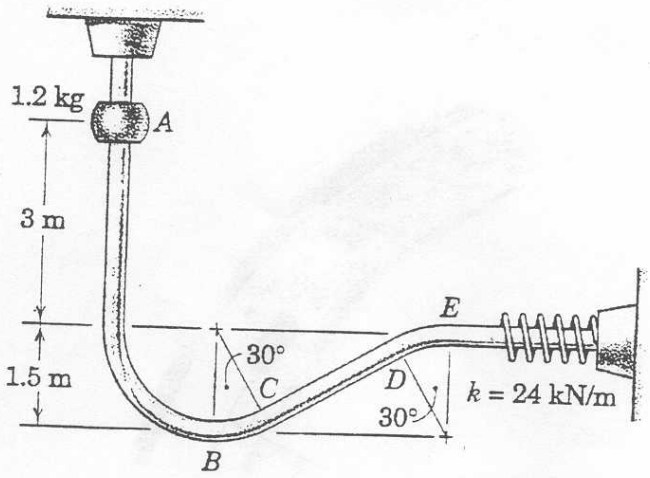
$V_A = -3t^2$ $\quad V_A + 2(V_C + V_B) = 0$

$V_B = 1.5t^2$ $\quad -3t^2 + 2V_C = -2V_D$

$12 - V_C = V_D$

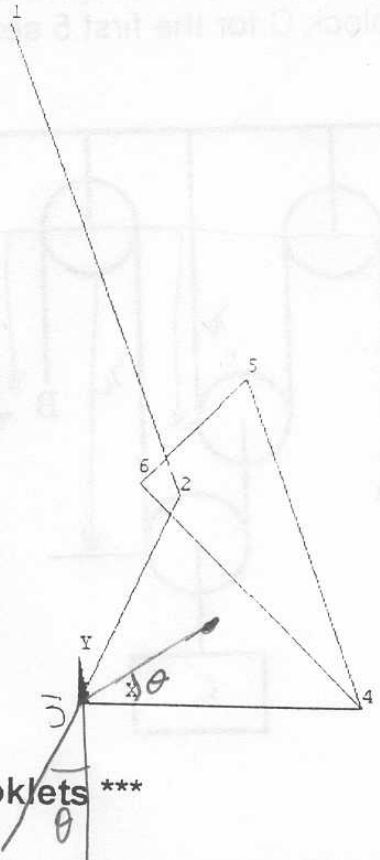
Q2) The 1.2-kg slider is released from rest at position A and slides without friction along the plane-guide as shown. Determine (a) the speed v_B of the slider as it passes position B, and (b) the maximum deflection x of the spring.

$t_f = 52.919\ s$



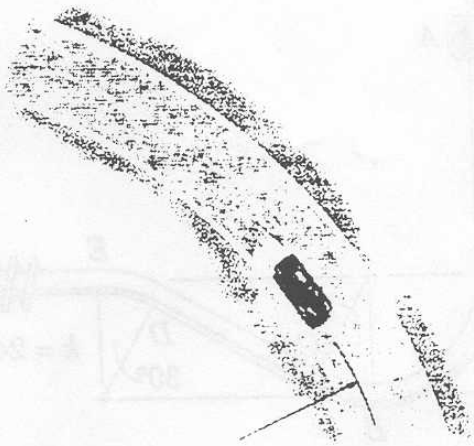
$S = 2l_{cord}$

Q3) For the wire sculpture shown, find the center of mass. Assume the wires to be uniform and homogenous. If the sculpture were hung from point 3 what would be the angle θ between length **3-4** and the vertical. Point locations are as follows in x and y axes: 1(-10,85), 2(12,26), 3(0,0), 4(35,0), 5(20,41), 6(7,28)

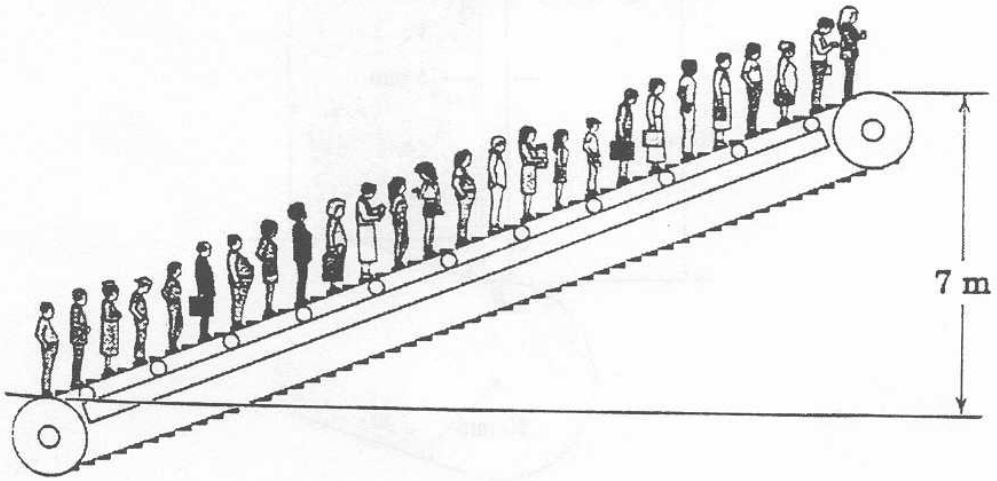


***** Please Change Test Booklets *****

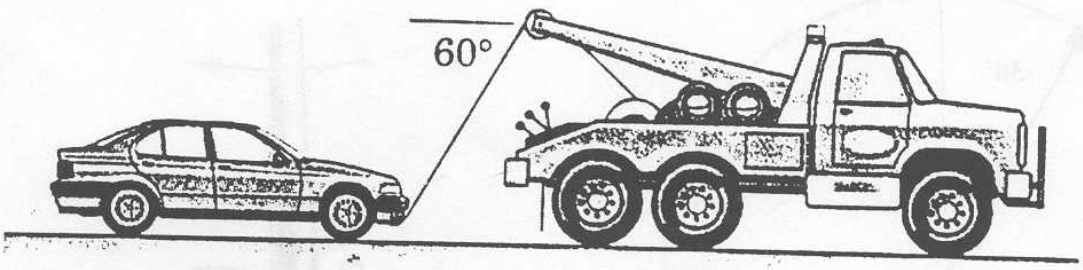
Q4) Find (a) the minimum radius of a curve a car of mass *m* can negotiate without slipping at 50 km/h, given that the coefficient of friction between the car and a dry road is 0.72. (b) Using the radius found in (a) determine the speed the driver must travel in the winter if the coefficient of friction decreases to 0.3



Q5) A department store escalator handles a steady load of 30 people per minute, elevating them from the first to the second floor through a vertical rise of 7 m. The average person has a mass of 65 kg. If the motor that drives the unit delivers 3 kW, calculate (a) the efficiency of the system, and (b) for a perfectly efficient system determine the maximum number of people the escalator could handle (round down to the nearest person)

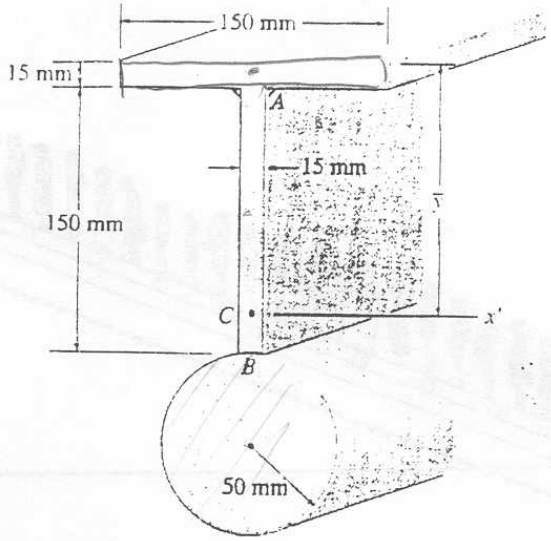


Q6) The tow truck and the attached 1200-kg car accelerate uniformly from 30 km/h to 70 km/h over a 15-s interval. The average impulsive rolling resistances for the car over this speed interval is 500 N. Assume that the 60-degree angle shown represents the time average configuration. Determine the average tension in the tow cable.



*** Please Change Test Booklets ***

Q7) For the following cross sectional area determine Ix' and Iy' at the centroid. The calculated value of y-bar is 154.4 mm.



Q8) A golf ball testing apparatus releases a 2-kg golf club from rest at an angle of 30 degrees from the vertical. The golf club pivots around the origin of the swing radius as shown with negligible friction. The club contacts the ball at the bottom of the swing plane. Given that the length of the club from pivot to strike point is 2 m, the club head has a 25 degree face, the impact with the ball is completely elastic, and that the mass of the ball is 45.9 g, determine how far the ball will travel. Assume the following: the entire mass of the club acts at the end, air resistance in negligible.